TECHNICAL MANUAL

QUALITY CONTROL
OF
PROPELLANT PRESSURIZING AGENT, HELIUM

(ATOS)

F41608-80-D-A006

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This publication supersedes T.O. 42B7-3-1-2, dated 15 December 1980, which will be removed from active files.

Published Under Authority of the Secretary of the Air Force

1 APRIL 2004

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INTRODUCTION

1. PURPOSE.

WARNING

Displacement of air by sufficient release of helium can make oxygen so scarce that asphyxiation and death can occur.

This technical manual provides guidance, standards, methods, and procedures for establishing and maintaining quality control of propellant pressurizing agent, helium, Specification MIL-PRF-27407, Type I, Grade A.

2. SCOPE.

This manual covers the quality control procedures that must be exercised over Air Force generation, procurement, handling and transfer, and storage of helium used in pressurizing missile propellant tanks.

CHAPTER 1
GENERAL

1.1 RESPONSIBILITIES.

An effective quality control program requires people from supply, maintenance, engineering, and procurement to work together.

1.2 PERSONNEL.

Personnel selected to perform operations in the helium supply system shall be trained in a thorough knowledge of the characteristics of helium, its contaminants, and the system in which it is used. Reliable and knowledgeable personnel are the key to an effective quality control program.

1.3 SOURCE.

Helium occurs in minute amounts in the atmosphere and in small amounts in some natural gases from sources located in the large gas fields of the Texas panhandle, Oklahoma panhandle, and Western Kansas. The principal helium resource is natural gas which contains about one-half to two percent helium, and it is the only known source from which it can be extracted economically.

1.4 HANDLING AND STORAGE.

The proper handling and storage of helium requires exercising precautions to prevent contamination and to avoid waste and loss of the material. Leakage should immediately be reported to the responsible authority.

1.5 SAFETY.

Safety for personnel who are responsible for performing operations associated with receipt, transfer, and quality control of helium is established in operation-service manuals such as AFMAN 20-203V2.

WARNING

a. High-Pressure – Pressure can cause great injury to personnel and damage to equipment when released uncontrollably. If the valve of a full cylinder is broken, the cylinder will rapidly attain high speed. A speeding cylinder can penetrate walls. Systems that are over pressurized can rupture lines which will whip damaging equipment and injuring personnel.

b. Asphyxiation – Sufficient concentration of helium in a poorly ventilated or unventilated enclosure may cause a dangerous reduction of the oxygen content of the air. Reduced oxygen concentration may result in asphyxiation.

CHAPTER 2
QUALITY CONTROL OF HELIUM AT MISSILE COMPLEXES

2.1 INTRODUCTION.

Helium used for flight pressurization of the missile fuel and liquid oxygen tanks, must be continuously surveyed to prevent contamination of the propellants. Quality control of helium begins upon receipt and continues through its storage in the propellant Loading System. Each operation in the missile helium supply system must be carried out in strict compliance with established quality control and safety procedures.

2.2 SCOPE.

This chapter establishes procedures and requirements for the quality control of helium that is procured, transferred, and stored for use in pressurizing missile propellant tanks. This chapter is applicable to base personnel who are responsible for supervision of the operations associated with receipt, transfer, and storage of helium.

2.3 USE LIMITS.

Use limits establish minimum quality levels related to the end use of the product. They are a second level of quality. Generally, a margin of quality between use limits and procurement limits is necessary to provide for contamination increase during handling and storage. These limits are specified in Table 2-1.

2.4 RECEIPT OF HELIUM.

The helium used by the Air Force for pressurizing missile propellant tanks is MIL-PRF-27407, Type I, Grade A, helium. Government inspection is performed at each contractor shipping point and the delivery of product is accompanied by a procurement limits test report, signed by an authorized inspector. Upon receipt of the product from a plant, sampling and testing the contents of the transport container are not required before unloading. However, when evidence of possible contamination exists, report the condition to the responsible Government Quality Assurance Representative (QAR) and to WR-ALC/AFTT before unloading the shipment. Request immediate investigation and appropriate action.

2.5 SAMPLING AND TESTING REQUIREMENTS.

WARNING

Helium must not be serviced into the missile if the contents of the storage container have reached the use limits. Whenever the use limits are reached, the storage container shall be flushed and cleaned In Accordance With (IAW) MIL-STD-1411.

Samples should be drawn and tested IAW Table 2-2. Test results shall conform to the use limits of Table 2-1.

2.6 SAMPLING.

If control of particulate matter content is required in the user's helium dispensing equipment, then it is recommended that a 10 micron or better nominal filter be installed in the service line. Samples of helium shall be taken with a high pressure gas cylinder having a working pressure of 1800 psig. The sample of helium is tested for purity, moisture, and total hydrocarbons.

2.7 SAMPLING PROCEDURES.

To assure that a representative sample of helium is taken, strict compliance with the following sampling procedures is required:

a. Allow a momentary gas flow from the helium manifold to clean out all foreign matter.

b. Attach the sample cylinder with a 3/8 inch flexible hose to the helium manifold outlet, downstream of the regulator.

c. With the manifold pressure regulated to 20 psig, open the valve on the sampler cylinder.

d. Slowly, and in approximately two minutes time, increase the manifold pressure to 1800 ± 20 psig. Record the final pressure of the sample cylinder.

Table 2-1. Use Limits for Helium

Total Hydrocarbons ppm	Purity Percentage by Volume	Moisture at 70°F and 760 mm
200 ppm by volume as methane equivalent	99.0 (minimum)	–70°F (dewpoint, 16.6 ppm)

e. Shut off all valves and disconnect the flexible hose at the sample cylinder to bleed the residual helium in the hose.

2.8 LABORATORY TEST EQUIPMENT.

Laboratory test equipment as designated in Specification MIL-PRF-27407 shall be utilized for testing requirements. For purity testing, the Gow-Mac 50 Series Continuous Gas Analyzer with a Thermal Conductivity Detector may be utilized.

Table 2-2. Requirements for Sampling and Testing Air Force Maintained Helium Storage Equipment

Sampling and Testing Frequency	Launch Site Storage Tanks	Air Force Maintained Trailers
	Within 30 days prior to launch	At least once every 30 days
Sampling Location	IAW applicable T.O.	
Sampler	High Pressure Cylinder Sampler	
Testing Locations	Aerospace Fuels Laboratory OL DET 3, WR-ALC/AFTLE 1747 Utah Ave., Bldg 6670 Vandenberg AFB, CA 93437-5220 Aerospace Fuels Laboratory OL DET 3, WR-ALC/AFTLH 15251 Scrub Jay Street, Bldg 54800 Cape Canaveral AFS, FL 32920	
Tests	Purity, Total Hydrocarbons, and Moisture	
Quality Control Requirements	Test results shall conform to Table 2-1.	

CHAPTER 3
HAZARDS AND SAFETY PRECAUTIONS

3.1 GENERAL.

Helium presents a constant hazard from the high pressures under which it is received, transferred, stored, and sampled. In addition to the hazards from the explosive and propulsive potential of lines and cylinders, a severe personnel hazard exists from any leak in the cylinders, valves, and piping of the launch site storage system. Stored at such extremely high pressures (6,000 psi), the tremendous jet force of a leak in the system can easily penetrate any portion of the body which comes in close contact with the leak.

3.2 SCOPE.

This chapter is applicable to base personnel who are responsible for supervising the operations associated with receipt, transfer, and quality control of helium.

3.3 PERSONNEL AND RESPONSIBILITIES.

It is the direct responsibility of all supervisors to assure that all personnel are carefully trained and thoroughly instructed in the operation of equipment and the hazards involved. Standard Operating Procedures shall be established and revised at regular intervals to keep current with changing conditions and practices in the operation of high pressure gas systems.

3.4 UNLOADING RAILWAY TANK CARS.

a. Unloading operations shall be performed only by personnel properly trained in the operation of the equipment.

b. Brakes must be set and wheels blocked on all tank cars being unloaded.

c. Caution signs must be so placed on the track or car as to give necessary warning to persons approaching the car from open end or ends of siding and must be left up until after the car is unloaded and disconnected from discharge connection. Signs must be of metal or other suitable material, at least 12 by 15 inches in size and bear the words STOP-TANK CAR CONNECTED or STOP-MEN AT WORK, the word STOP being in letters at least four inches high and other words in letters at least two inches high. The letters must be white on a blue background.

d. Do not tamper with safety-relief devices.

e. In the event of any leak in the valves or fittings of the tank car, inform the supervisor in charge.

f. Unloading operations shall be performed in strict compliance with Standard Operating Procedures.

3.5 LOADING ON-BASE MAINTAINED SEMITRAILERS.

Loading helium into the on-base maintained semitrailers from the railway tank cars shall be performed IAW T.O. 36A9-12-2-1, COMPRESSED GAS CYLINDER SEMITRAILER, TYPE MH-1, OPERATION.

3.6 UNLOADING ON-BASE MAINTAINED SEMITRAILERS.

Unloading helium from the on-base maintained semitrailers into the launch site storage tanks shall be performed IAW the instructions of T.O. 36A9-12-2-1, COMPRESSED GAS CYLINDER SEMITRAILER, TYPE MH-1, and T.O. 34Y1-137-1, HELIUM COMPRESSOR, TYPE AF-M26A-4.